

### LIST OF PLATES

PLATE 7-1	WATER MONITORING LOCATIONS
PLATE 7-2	AREA TOPOGRAPHY
PLATE 7-3	WATER RIGHTS
PLATE 7-4	DRAINAGE DIVERSIONS
PLATE 7-5	DRAINAGE AREAS
PLATE 7-6	SEDIMENTATION POND DETAIL MAP
PLATE 7-6A	WEIR/OIL SKIMMER AND CROSS SECTION
PLATE 7-7	RECLAMATION DRAINAGE
PLATE 7-7A	RECLAMATION EROSION CONTROL MEASURES

### APPENDICES

APPENDIX 7-1	JOSEPH A. HARVEY LETTER
APPENDIX 7-2	GROUNDWATER BASELINE DATA
	<b>Attachment A - In-Mine Water Sampling</b>
APPENDIX 7-3	SURFACE WATER BASELINE DATA
APPENDIX 7-4	DESIGN CALCULATIONS
APPENDIX 7-5	LOGS OF HZ MONITORING WELLS
APPENDIX 7-6	LETTER REGARDING ALLUVIAL VALLEY FLOORS
APPENDIX 7-7	DATA FROM USGS STREAM-GAGING STATION ON BEAVER CREEK
APPENDIX 7-8	SLUG TEST RESULTS
APPENDIX 7-9	ESTIMATED WATER USE REQUIREMENTS
APPENDIX 7-10	SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN
APPENDIX 7-11	ADDITIONAL AQUIFER DATA
APPENDIX 7-12	STREAM ALTERATION PERMIT

File in:

☐ Confidential

☐ Shelf

☒ Expandable

Refer to Record No. 0066 Date 08031999

In C 0070020 1999 Incoming

For additional information

**COPY**

Horizon Mine  
P.O. Box 599  
Helper, UT 84526

August 3, 1999

Utah Coal Program  
Utah Division of Oil, Gas & Mining  
1594 West No. Temple, Suite 1210  
Salt Lake City, UT 84114-5801

The purpose of this letter is to address the amendment being submitted for the in-mine water sampled and currently being discharged to the sediment pond at Horizon Mine. The amendment addresses NOV-99-26-2-1. The information for in-mine water is contained in Appendix 7-2, Attachment A. Maps showing the in-mine sample location and drainage area are provided as attachments.

Enclosed are two copies of the amendment, a third copy was delivered to the Price Field Office.

Please contact me if you have any questions.

Sincerely,



Vicky S. Bailey  
Permitting Consultant  
EarthFax Engineering, Inc.



# APPLICATION FOR PERMIT PROCESSING

# COPY

Permit Change <input type="checkbox"/>	New Permit <input type="checkbox"/>	Renewal <input type="checkbox"/>	Transfer <input type="checkbox"/>	Exploration <input type="checkbox"/>	Bond Release <input type="checkbox"/>	Permit Number: ACT/007/020
Title of Proposal: In-Mine Water Monitoring Information per NOV-99-26-2-1 Compliance						Mine: HORIZON
						Permittee: LODESTAR ENERGY, INC.

Description, include reason for application and timing required to implement:

**Instructions:** If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation specialist.

<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	1. Change in the size of the Permit Area? _____ acres Disturbed Area? _____ acres <input type="checkbox"/> increase <input type="checkbox"/> decrease.
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	2. Is the application submitted as a result of a Division Order? DO # _____
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	4. Does application include operations in hydrologic basins other than as currently approved?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	6. Does the application require or include public notice/publication?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	9. Is the application submitted as a result of a Violation? NOV # 99-26-2-1
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	10. Is the application submitted as a result of other laws or regulations or policies? Explain: _____
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	11. Does the application affect the surface landowner or change the post mining land use?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2?)
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	13. Does the application require or include collection and reporting of any baseline information?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	15. Does application require or include soil removal, storage or placement?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	17. Does the application require or include construction, modification, or removal of surface facilities?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	18. Does the application require or include water monitoring, sediment or drainage control measures?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	19. Does the application require or include certified designs, maps, or calculations?
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	20. Does the application require or include subsidence control or monitoring?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	21. Have reclamation costs for bonding been provided for?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

**Attach 2 complete copies of the application. 1 COPY DELIVERED TO THE PRICE FIELD OFFICE.**

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Signed - Name - Position - Date

Subscribed and sworn to before me this 3 day of Aug, 19 99

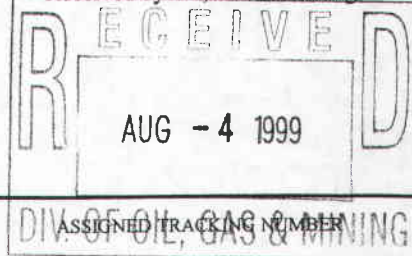
Notary Public

My Commission Expires  
STATE OF  
COUNTY OF



MICHAEL A. HESS  
NOTARY PUBLIC - STATE OF UTAH  
ONE NORTH MAIN  
SP FORK UT 84660  
COMM. EXP 11-6-2001

Received by Oil, Gas & Mining





# Application for Permit Change

## Detailed Schedule of Changes to the Permit

**COPY**

Title of Change: In-Mine Water Monitoring Information per NOV-99-26-2-1

Permit Number: 007/020

Mine: Horizon

Permittee: LODESTAR ENERGY

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit change. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the exiting mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
<input type="checkbox"/> ADD	<input checked="" type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Chapter 7, Page iv of the Table of Contents, Pages 7-32 and 7-76
<input checked="" type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	Appendix 7-2, Attachment A - In-Mine Water Sampling
<input type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	
<input type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	
<input type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	
<input type="checkbox"/> ADD	<input type="checkbox"/> REPLACE	<input type="checkbox"/> REMOVE	

August 3, 1999

during mining operations or until the flow diminishes. Data will be collected as close to the point of issuance as possible to prevent contamination by mining operations.

Sampling information for in-mine water flow was collected at the locations noted on Plate A and B, Appendix 7-2, Attachment A. The analyzes associated with the samples are included in Appendix 7-2, Attachment A. Additional sampling for TSS was requested by Utah Division of Water Quality, these analyzes are also included in Attachment A.

The in-mine water pumped and discharged to the surface was measured daily when personnel were at the mine (Appendix 7-2, Attachment A, Horizon In-Mine Water Log, 1998 - 1999). Other days, such as weekends and holidays the flow was estimated. The flow was measured as the water exited through a pipe or a weir and collected in a five gallon bucket.

The Horizon In-Mine Water Log, 1998 - 1999 shows the flow in gallons per day. Empty boxes in the chart signify no discharge of in-mine water, the other symbols are defined on the third page of the log.

~~Should~~ Discharge of water from the mine become necessary, the water will be treated in underground sumps, ~~if needed~~, to meet effluent limitations. Discharged water will be monitored as described above and in accordance with the discharge permit issued by the Division of Water Quality.

While sampling the HZ wells immediately after drilling, each well was pumped for a period of 2 to 4 weeks, during which time the wells were repeatedly pumped dry and allowed to recover. The samples were collected at the end of the above periods. Given the fact that the wells still appeared to be influenced by foam drilling fluids when sampled (based on pH, discoloration, etc) and the fact that sampling required an extended period of time due to the low yield of the wells, future sampling of the wells for water-quality analyses is not proposed. Rather, data collected from the wells in the future will consist solely of water-level information. Springs and mine-water inflows will be used to monitor changes in water quality within the permit and adjacent areas.

Water-level data will be collected during the operational and reclamation phases from the HZ wells once each quarter when accessible. All water-level measurements will be corrected to depth from top of 2" casing to permit correlation with previous measurements. Horizon commits to discuss with UDOGM a more stringent monitoring program for well HZ-95-1 prior to entering the northernmost mining block in Section 8.

Data collected from the springs to be monitored (SP-1, SP-2, SP-4, SP-9, 2-6-W, and GV-70) will provide information on the potential impacts of mining activities on localized aquifers. Similar information will be obtained by monitoring sustained inflows to the mine workings. Data obtained from the HZ monitoring wells will assist in evaluating potential losses of groundwater from the Blackhawk/Star Point aquifer system.

groundwater or under the condition that water is discharged from the mine to surface water resources.

North Fork Gordon Creek flows across the Mancos Shale immediately downstream from the mine area. Since the Mancos Shale is a gypsiferous formation, sulfate and TDS concentrations naturally increase as the surface water contacts this formation (Waddell et. al., 1981). Thus, increases in TDS concentrations downstream from the surface facilities, if they occur, will more likely result from natural conditions rather than mining impacts.

As noted above, it is anticipated that ~~a small amount of water may~~ **will** be discharged from the mine workings to the surface during the initial permit term. As mining progresses during future permit terms, additional water will likely be pumped from the mine. As also noted above, the mine water is anticipated to have a TDS concentration which approximates that of the surface water immediately downstream from the proposed surface facilities.

If the excess groundwater encountered in the mining operation was allowed to flow naturally rather than being discharged from the mine, this water would flow naturally downgradient and eventually discharge into the North Fork of Gordon Creek (see the potentiometric surface map presented in Figure 7-2). As it flows downgradient, the water would come increasingly into contact with the underlying Mancos Shale, dissolving additional salts in the process. Hence, water which is discharged from the mine should have a lower TDS concentration than that which would seep naturally into the local surface-water system. As a result, the TDS concentration of surface water downstream from the proposed surface facilities will be improved (i.e., decreased) if water is discharged from the mining operation.

Information regarding the acid- and toxic-forming potential of the coal, as well as the roof and floor materials, is presented in Section 6.5.6 of this document. As indicated therein, the roof and floor materials (i.e., that which may become waste rock) is neither acid nor toxic forming, suggesting that the material which comprises coal parting would also not be acid- or toxic-forming. However, the coal has a potential to be acid forming. The acid-forming potential of the coal will be tempered by its slightly alkaline nature (with a pH that varies from 7.3 to 7.8, according to Appendix 6-2). Furthermore, impacts to the environment of the permit and adjacent areas resulting from this acid-forming potential will be minimized by three factors. First, coal will be stored on the surface for only short periods of time before being shipped off site, thus reducing the potential for weathering, oxidation, and generation of acid drainage. Second, runoff from the coal stockpile will be routed through the facility sedimentation pond, where it will mix with more-alkaline runoff from additional areas, thus neutralizing any acidic drainage which might form. Finally, acidic leachate which is generated from coal which is left underground and exposed to the mine air will be buffered by the naturally alkaline environment in which the coal occurs. Hence, impacts to the acidity of the local hydrologic system are not anticipated.

Public Water Supplies. The water located in the Gordon Creek Drainage system is not a culinary water supply. The water in this drainage is used for agricultural, livestock, wildlife and industrial use (see Appendix 3-3).

Water derived from the spring associated with water rights 91-94 and 91-353 will be piped to Sweet's Pond and pumped from there to the mine for surface and underground use. As noted previously, it is not anticipated that large quantities of groundwater will be discharged from the

APPENDIX 7-2  
GROUNDWATER BASELINE DATA

Add to back of existing data

APPENDIX 7-2  
ATTACHMENT A

IN-MINE WATER SAMPLING



# BASELINE DATA - JEWKES CREEK

	4/11/98	6/30/98	9/98	12/98	
Parameters					
Beryllium	0.0003	-	-	-	
Copper	0.014	-	-	-	
Iron	4.99	4.73	3.29	2.4	
Manganese (Diss)	0.009	0.003	0.012	< 0.1	
Manganese	0.185	0.167	0.088	0.1	
Zinc	0.035	-	-	-	
TDS	475	540	489	626	
TSS	503	298	253	186	
Cations	9.2	10.1	9.2	11.6	
Anions	8.8	9.9	8.6	12.1	
Magnesium	41.7	58.9	44.4	63	
Calcium	104	86.6	93.2	112	
Potassium	3.81	3.65	3.31	4	
Sodium	10.5	18.6	19.3	16	
Fluoride	0.38	0.45	0.52	-	
Chloride	13.7	26.4	15.9	24	
Nitrate Nitrogen	0.060	U	U	-	
Sulfate	77.4	147	U	151	
Bicarbonate	340	304	320	505	
Total Alkalinity	340	304	324	414	

Location where samples were taken are shown on Plate A included in Appendix 7-2, Attachment A. The sample designated as "receiving water", submitted for the W.E.T. test was taken from Jewkes Creek above the mine pad area.

*Is this with  
water discharge from mine  
when pipe was  
placed in  
this location?*

# BASELINE DATA - OLD BLUE BLAZE MINE (BBM)

Parameters (detected)	12/18/97	4/11/98	
pH (Std. Units)	7.39	-	
Oil & Grease mg/l	4	-	
Selenium mg/l	0.19	-	
Iron mg/l	0.41	0.81	
Manganese (Diss) mg/l	-	0.056	
Manganese mg/l	-	0.062	
Zinc mg/l	-	0.032	
TDS mg/l	408	426	
TSS mg/l	-	238	
Cations meq/l	-	8.1	
Anions meq/l	-	8.0	
Magnesium mg/l	-	30.1	
Calcium mg/l	-	99.2	
Potassium mg/l	-	6.16	
Sodium mg/l	-	12.0	
Fluoride mg/l	-	0.21	
Chloride mg/l	-	7.4	
Nitrate Nitrogen mg/l	-	0.125	
Sulfate mg/l	-	67.6	
Bicarbonate mg/l	-	318	
Total Alkalinity mg/l	-	318	

Location where samples were taken are shown on Plate A and B included in Appendix 7-2, Attachment A. BBM is used to delineate samples taken in the Old Blue Blaze Mine.

# BASELINE DATA - HORIZON ROOF

Parameters (detected)	4/11/98	
Beryllium		
Copper		
Iron		
Manganese (Diss)	0.026	
Manganese	0.028	
Zinc		
TDS	333	
TSS	398	
Cations	7.9	
Anions	6.4	
Magnesium	33.0	
Calcium	87.7	
Potassium	6.8	
Sodium	14.9	
Fluoride	0.16	
Chloride	6.9	
Nitrate Nitrogen	0.31	
Sulfate	71.3	
Bicarbonate	236	
Total Alkalinity	-	

Location where samples were taken are shown on Plate A and B included in Appendix 7-2, Attachment A. HM is used to delineate samples taken in the roof of the mine.

POND 001 DISCHARGE DATA

Parameters (detected)	4/22/98	4/29/98*	5/13/98	5/26/98#	5/26/98	6/15/98
Iron	1.55	0.147	0.1	0.5	0.51	0.31
Selenium	U	-	<0.01	-	U	U
pH	8.04	8.2	7.93		7.96	7.94
TSS	71	8.4	4230**	63	50	41
TDS	401	376	399	397	406	388
Oil & Grease	2	-	<2	<2	U	U
Sulfate	88.9	-	73	-	98	77.8
Temperature (C)	-	12.2	-	-	-	-
D.O. (mg/l)	-	9.0	-	-	-	-
Flow (gpm)	-	60	-	-	-	-
Sp. Cond. (umhos/cm)	-	638	-	-	-	-

\* Sample taken by UDWQ

\*\* Lab Error

# Sample taken by UDOGM

# POND 001 DISCHARGE DATA

Parameters (detected)	7/13/98	8/26/98	9/30/98	10/3/98	11/30/98*	12/31/98*
Iron	0.3	0.191	0.043	0.058	-	-
Selenium	<0.01	U	U	U	-	-
pH	7.36	7.95	7.92	7.14	7.99	8.05
TSS	14	20	U	6.0	-	-
TDS	384	400	261	349	283	81
Oil & Grease	2	U	U	U	-	-
Sulfate	71	71.1	62.9	60.9	-	-

\* No Discharge, field parameters taken in pond



POND 001 DISCHARGE DATA

Parameters (detected)	1/1/99	2/25/99	3/31/99	4/30/99	5/20/99	
Iron	<0.1	0.2	<0.1	0.2	<0.1	
Selenium	@	@	<0.01	<0.01	<0.01	
pH	7.44	8.08	7.93	8.12	8.00	
TSS	18	7	9	19	5	
TDS	289	375	354	356	332	
Oil & Grease	<2	<2	<2	<2	<2	
Sulfate	@	@	72	86	71	

@ Lab and mine error due to change in personnel



# **Earth Fax Engineering**

**Horizon Mine**

**Chronic Toxicity Report**

**By: Water & Environmental Testing, Inc.**

# **Table of Contents**

## **Chronic Toxicity Tests**

### **Fathead Minnow**

**Test Summary**

**Test Data**

### **Ceriodaphnia dubia**

**Test Summary**

**Test Data**

### **Sample Chemistries**

## **Data Reduction**

### **Fathead Minnow**

**Survival (Proportion Alive) LC50 NOEC/ LOEC**

**Growth IC25 NOEC/ LOEC**

### **Ceriodaphnia dubia**

**Survival (Proportion Alive) LC50 NOEC/ LOEC**

**Reproduction IC25 NOEC/ LOEC**

## **Quality Control**

**Fathead Minnow Monthly Reference Toxicant Chart**

**Ceriodaphnia dubia Monthly Reference Toxicant Chart**

## **Chain of Custodies**

## **Chronic Test Data**

## **Chronic Toxicity Report**

### **Fathead Minnows**

DATE: May 3, 1998

CUSTOMER ID: Earth Fax Engineering

SAMPLE SITE: Horizon Mine

Log #: 2091

TEST (Animal/Age): Fathead Minnow &lt;24 hours

SAMPLE (Date/Type): 4/19/98 grab

DATE/TIME TEST BEGAN: 4/19/98 9:45 pm

DATE/TIME TEST COMPLETED: 4/26/98 10:30 pm

### **TEST CONDITIONS**

Fathead Minnow larvae were exposed to diluted effluent following the procedures outlined in EPA-600-4-91/002. The solutions were renewed daily. Survival and Growth were measured at the end of the test period and statistically evaluated against the control to determine if chronic toxicity was present in the samples.

Animal Age at Test Start	<48 hours
Number of Organisms/Dilution Volume/Replicates	10 organisms/200 ml/4 replicates
Food	Fed twice daily newly hatched artemia (brine shrimp)
Aeration	None
Dissolved Oxygen	Measured daily old/new.
Water Replacement	Renewed daily.
Temperature	25 ± 1 degree C.
Photo Period	16 hours light 8 hours dark.
pH	Initially and after 24 hours for every sample used.
Dilution Water	Reconstituted lab water approx 400 mg/L hardness.
Receiving Water	Jewkes Creek.
Sample Concentrations	Control, 6.25, 12.5, 25, 50, 100%

### **SUMMARY**

Results:      X    PASS      FAIL

There was NO significant effect on growth. (Results of Dunnett T Test)

NOEC (Growth) = &gt;100%

LOEC (Growth) = &gt;100%

IC25 = &gt;100%

There was NO significant effect of survival. (Results of Steel's Many-One Rank Test).

NOEC (Survival) = &gt;100%

LOEC (Survival) = &gt;100%

LC50 = &gt;100%

Enclosed are data sheets and statistical reports.

Sincerely,

  
Lee Rawlings

Water &amp; Environmental Testing, Inc.

Enclosure



# W.E.T. Inc.

Water & Environmental Testing Inc. 479 West 50 North, American Fork, Utah 84003 (801)756-8397

## Chronic Toxicity Testing Fathead Minnow

Customer ID: Earth Fax Engineering

SAMPLE SITE: Horizon Mine

Log #: 2091

Final Mean Weight mg/fish: Control 0.34 6.25% 0.42 12.5% 0.39 25.0% 0.45 50.0% 0.48 100% 0.46

Percent Lethality: Control 0% 6.25% 0% 12.5% 5% 25.0% 10% 50.0% 0% 100% 0%

Sample Type/Date: 4/19/98 grab

Analyses Dates/Times Beginning 4/19/98 9:45 pm Ending 4/26/98 1030 pm

Initial Organism Age: <48 hours

Hardness Dilution Water: Reconstituted Water approximately 400 mg/L

### FATHEAD MINNOWS Replicates

Number of Organisms/Percent Survival					Mean Weight after 7 days (mg/fish)				
Sample	A	B	C	D	A	B	C	D	Mean Weight
Control	10/100%	10/100%	10/100%	10/100%	.30	.33	.41	.33	.343
6.25	10/100%	10/100%	10/100%	10/100%	.38	.45	.45	.38	.415
12.5	10/100%	9/90%	10/100%	9/90%	.42	.33	.39	.43	.393
25.0	8/80%	9/90%	10/100%	9/90%	.53	.49	.45	.34	.453
50.0	10/100%	10/100%	10/100%	10/100%	.49	.45	.43	.54	.478
100	10/100%	10/100%	10/100%	10/100%	.45	.48	.40	.52	.463

Concentration (%)						
Max/Min	Control	6.25	12.5	25.0	50.0	100
Dissolved Oxygen	8.2/2.1	8.5/2.8	8.9/2.3	8.7/2.1	7.9/2.5	9.1/2.1
Temperature (°C)	25.6/24.0	25.6/24.0	25.6/24.0	25.6/25.0	26.0 25.0	25.6/25.0
Ph	8.36/7.99	8.35/7.94	8.27/7.94	8.10/8.01	7.84/7.89	7.42/7.86

Dilution Water (Average) Hardness: 420 mg/L Alkalinity: 260 mg/L Conductivity: 1,232 umhos/cm

Analyst: Lee Rawlings Laboratory: Water & Environmental Testing, Inc.

Signature: Lee Rawlings

Date: 5/3/98

Comments: Receiving water also tested: Growth average .395 mg/fish. Survival 97.5%.

## Chronic Toxicity Report *Ceriodaphnia*

Date: May 3, 1998

CUSTOMER ID: Earth Fax Engineering

SAMPLE SITE: Horizon Mine

Log #: 2091

TEST (Animal/Age): Ceriodaphnia <8 hours

SAMPLE (Date/Type): 4/19/98 grab

DATE/TIME TEST BEGAN: 4/19/98 10:15 p.m.

DATE/TIME TEST COMPLETED: 4/27/98 11:00 p.m.

### TEST CONDITIONS

Ceriodaphnia neonates were exposed to the diluted effluent following procedures from EPA-600-4-91/002. The solutions were renewed daily. Survival and reproduction were measured at the end of the test period and statistically evaluated against the control to determine if chronic toxicity was present in the samples.

Animal Age at Test Start	<8 hours
Number of Organisms/Dilution Volume/Replicates	1 neonate/15 ml/10
Food	YCT with Algae (0.1 ml/daily)
Aeration	None
Dissolved Oxygen	Measured daily old/new.
Water Replacement	Renewed every 24 hours.
Temperature	25 ± 1 degree C. (see attached data sheets).
Photo Period	16 hours ambient light/8 hours dark.
pH	Measured initially and at 24 hours.
Dilution Water	Reconstituted lab water approx 400 mg/L hardness.
Receiving Water	Jewkes Creek
Sample Concentrations	Control, 6.25, 12.5, 25.0, 50.0, and 100%

### SUMMARY

Results:            PASS     X    FAIL

There WAS significant effect on reproduction. (Results of Dunnett T Test)

NOEC 25%

LOEC 50%

IC25 estimated at 31.7% using Linear Interpolation.

There WAS significant effect on survival. (Results of Fisher Exact Test)

NOEC 50%

LOEC 100%

LC50 of Chronic test >100%.

Enclosed are data sheets and statistical reports.

Sincerely,

  
Lee Rawlings  
Water & Environmental Testing, Inc.

Enclosure

## Chronic Toxicity Testing Ceriodaphnia

Customer ID: Earth Fax Engineering

SAMPLE SITE: Horizon Mine

Log #: 2091

Mean No. Produced: Control 20.5 6.25% 19.7 12.5% 23.5 25.0% 16.7 50.0% 13.8 100% 2.3

Percent Lethality: Control 0% 6.25% 0% 12.5% 0% 25.0% 10% 50.0% 30% 100% 40%

Sample Date/Type: 4/19/98 Grab

Organism Type/Age: Ceriodaphnia dubia <8 hours

Analyses Times and Dates: Beginning 4/19/98 10:15 p.m.

Ending 4/27/98 11:00 p.m.

Dilution Water Hardness: Reconstituted Water approximately 400 mg/L.

### CERIODAPHNIA

Total Number of Young Produced in Three Broods ("D" = dead)

#### Replicates

Sample	A	B	C	D	E	F	G	H	I	J	Mean # Produced
Control	17	15	23	14	24	20	23	16	20	33	20.5
6.25	19	21	12	23	20	15	27	16	19	25	19.7
12.5	28	17	22	26	29	17	20	18	28	30	23.5
25.0	10	14	25	28	7	25	11	15D	12	20	16.7
50.0	8	18	8D	15D	22	8D	9	23	15	12	13.8
100	0D	7	0	2	7D	1	0D	6	0D	0	2.3

#### Concentration (mg/L)

Max/Min	Control	6.25	12.5	25.0	50.0	100
Dissolved Oxygen	8.2/5.6	8.3/5.9	8.9/6.1	8.7/6.0	7.9/5.5	9.1/5.9
Temperature (°C)	26.0/25.0	26.0/25.6	26.0/25.6	26.0/25.6	26.0/25.6	26.0/25.6
Ph	8.36/8.35	8.35/8.36	8.27/8.36	8.10/8.36	7.84/8.30	7.57/8.17

Dilution Water (Average) Hardness: 420 mg/L Alkalinity: 260 mg/L Conductivity: 1232 umhos/cm

Analyst: Lee Rawlings Laboratory: Water & Environmental Testing, Inc.

Signature: Lee Rawlings

Date: 5/3/98

Comments: Receiving water also tested: Reproduction average 4.5 young/adult. Survival 80%.

**Chronic Whole Effluent Toxicity Chemical Result Report**

May 3, 1998

**CUSTOMER NAME:**Earth Fax Engineering  
Vicky Bailey**PHONE NUMBER:****FAX NUMBER:****SAMPLE DESCRIPTION:**

Chemistries to go with Chronic Toxicity Testing sampling began 4/19/98.

Analysis	Effluent Ceriodaphnia			Effluent Fathead Minnows		
	Repl. 1	Repl. 2	Repl. 3	Repl. 1	Repl. 2	Repl. 3
Log #	2091			2091		
Total Hardness, Recon (EPA 130.2), mg/L	420			420		
Total Hardness, Effluent (EPA 130.2), mg/L	372			372		
Ammonia, Effluent (EPA 350.2/350.3), mg/L	0.22			0.22		
Initial Chlorine Residual (EPA 330.5), mg/L	<0.05			<0.05		
Final Chlorine Residual (EPA 330.5), mg/L	—			—		
Conductivity, Effluent (EPA 120.1), umhos/cm	683			683		
Alkalinity, Effluent (EPA 310.1), mg/L CaCO <sub>3</sub>	305			305		
Recon Initial Ph (EPA 150.1)	8.36			8.36		
After 24 hours Ph (EPA 150.1)	8.35			7.99		
100% Initial Ph (EPA 150.1)	7.57			7.46		
100% After 24 hours Ph (EPA 150.1)	8.17			7.86		

  
Analyst: Lee Rawlings, Chemist  
Water & Environmental Testing, Inc.

## **Data Reduction**



5/02/98

## TOXIS ANALYSIS SUMMARY

=====

Fish Larvae		Proportion Alive			Day 7	
-------------	--	------------------	--	--	-------	--

=====

Lab	Species	Date	Test Material	Permit	Protocol	Test Number
UTWET	PP	4/19/98	EFF2 (%)	REF	EPAF 94	HORZN4/98B

=====

=====

EPA Flowchart	Auto growth select	1 control
---------------	--------------------	-----------

=====

	Conc	Mean	SD	N	T	Sum of Ranks
Data transformation: Arc sine sqrt w/ adj.						
X	0.00D	1.41	0.000	4		
X	6.25D	1.41	0.000	4	0.000	18.000
X	12.50D	1.33	.094	4	1.808	14.000
X	25.00D	1.25	.125	4	3.499	12.000
X	50.00D	1.41	0.000	4	0.000	18.000
X	100.00D	1.41	0.000	4	0.000	18.000

Data transformation: No transformation						
	0.00D	1.00	0.000	4		
	6.25D	1.00	0.000	4	0.000	18.000
	12.50D	.95	.058	4	1.808	14.000
	25.00D	.90	.082	4	3.499	12.000
	50.00D	1.00	0.000	4	0.000	18.000
	100.00D	1.00	0.000	4	0.000	18.000

NOEC	LOEC	TU	Alpha	Tail	Based on	Critical Sum of Ran
>100	>100	<	.05	One-sided	Steel	10

Dunnett Test:	MSE	MSD % Reduction from Control	Critical T	
	.00406	6.98212	2.41	
Shapiro-Wilk Test for Normality:	Alpha	W	Cutoff W	Normal?
	.01	.730647	.884	No
Bartlett Test for Equal Variance:	Alpha	B	P(B)	Equal Var?
	.01	9999	0	No

5/02/98

## TOXIS ANALYSIS SUMMARY

Fish Larvae

Weight

Lab	Species	Date	Test Material	Permit	Protocol	Test Number
UTWET	PP	4/19/98	EFF2 (%)	REF	EPAF 94	HORZN4/98B

EPA Flowchart	Auto growth select	1 control
---------------	--------------------	-----------

	Conc	Mean	SD	N	T
Data transformation:		No transformation			
X	0.00D	.34	.047	4	
X	6.25D	.42	.040	4	-1.899
X	12.50D	.39	.045	4	-1.310
X	25.00D	.45	.082	4	-2.881
X	50.00D	.48	.049	4	-3.536
X	100.00D	.46	.051	4	-3.143

NOEC	LOEC	TU	Alpha	Tail	Based on	Critical T
>100	>100	<	.05	One-sided	Dunnett	2.41

Dunnett Test:	MSE	MSD % Reduction from Control	Critical T
	.00291	26.8638	2.41
Shapiro-Wilk Test for Normality:	Alpha	W	Cutoff W
	.01	.972717	.884
			Yes
Bartlett Test for Equal Variance:	Alpha	B	P(B)
	.01	1.9271	.85913
			Yes

5/02/98

## TOXIS ANALYSIS SUMMARY

```

=====
Periodaphnia                      Reproduction
=====
Lab   Species   Date   Test Material   Permit   Protocol   Test Number
-----
UTWET   CD       4/19/98   EFF2 (%)       REF       EPAF 94     HORZN4/98
=====

```

```

=====
EPA Flowchart   Auto growth select   1 control
=====

```

	Conc	Mean	SD	N	T
Data transformation:	No transformation				
X	0.00D	20.50	5.642	10	
X	6.25D	19.70	4.596	10	.309
X	12.50D	23.50	5.255	10	-1.160
X	25.00D	16.70	7.304	10	1.469
X	50.00D	13.80	5.770	10	2.591
	100.00D	2.30	3.093	10	

NOEC	LOEC	TU	Alpha	Tail	Based on	Critical T
25	50		.05	One-sided	Dunnett	2.225

Dunnett Test:	MSE	MSD % Reduction from Control	Critical T
	33.44	28.0688	2.225
Shapiro-Wilk Test for Normality:	Alpha	W	Cutoff W    Normal?
	.01	.949019	.93        Yes
Bartlett Test for Equal Variance:	Alpha	B	P(B)    Equal Var?
	.01	2.0483	.72686    Yes

5/02/98

## TOXIS ANALYSIS SUMMARY

=====  
 Ceriodaphnia Proportion Alive Day 7  
 =====

Lab	Species	Date	Test Material	Permit	Protocol	Test Number
UTWET	CD	4/19/98	EFF2 (%)	REF	EPAF 94	HORZN4/98

=====  
 Fisher Exact Auto growth select 1 control  
 =====

Transformation	Prop. Conc	Alive	P
No transformation			
	X 0.00D	1.00	
	X 6.25D	1.00	1.000
	X 12.50D	1.00	1.000
	X 25.00D	.90	.500
	X 50.00D	.70	.105
	X 100.00D	.60	.043

NOEC	LOEC	TU	Alpha	Tail	Based on
50	100		.05	One-sided	Fisher Exact

# Inhibition Concentration (ICp) Using Linear Interpolation Analysis

Water & Environmental Testing, Inc.

Species: Ceriodaphnia dubia

Test Number: HORZN4/98

Test Material: Effluent - Industrial (%)

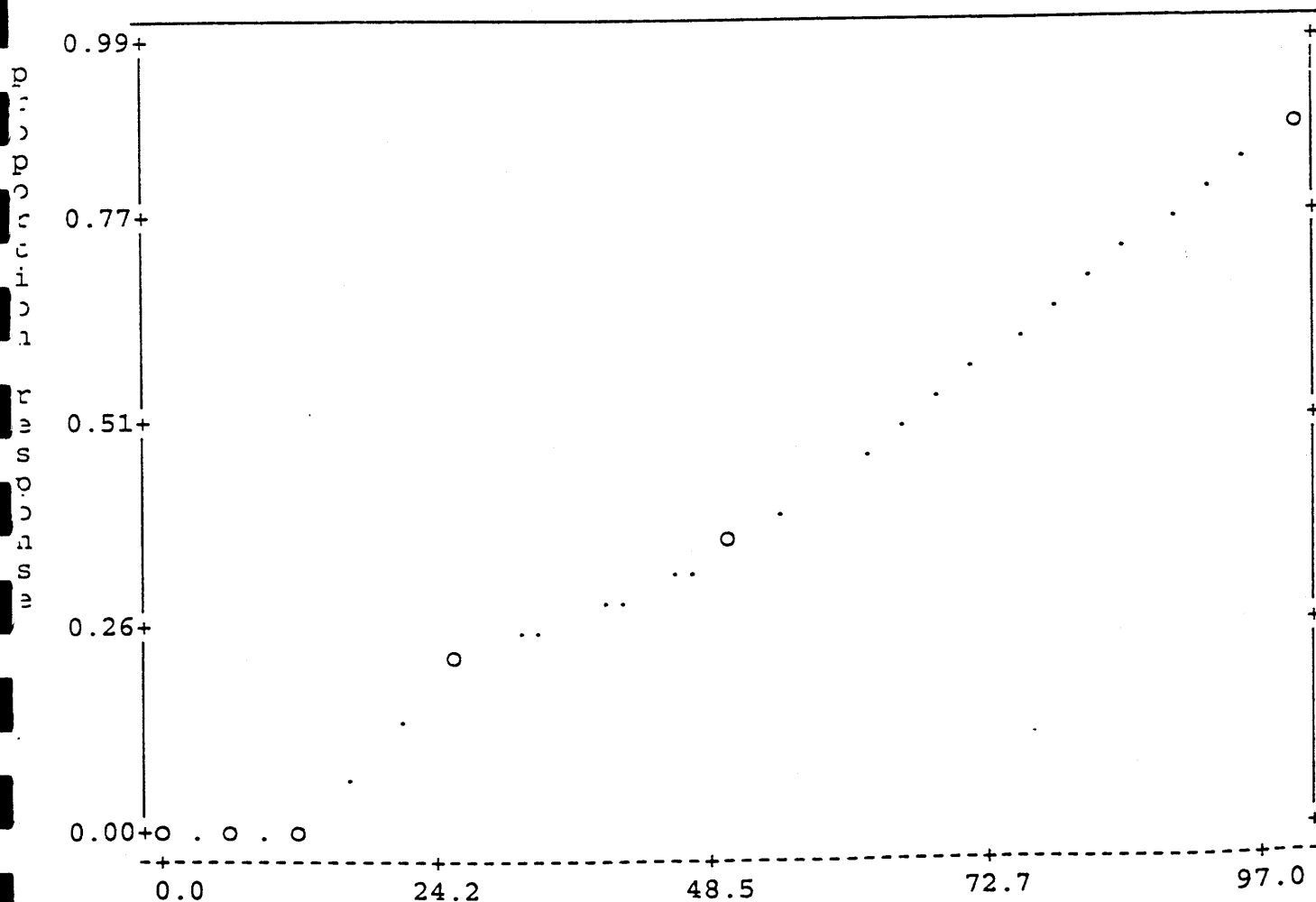
Test Date: 4/19/98

Endpoint: Total young

Concentration	Mean	Pooled Mean	Proportion Response
0.0000	20.5000	21.2333	0.0000
6.2500	19.7000	21.2333	0.0000
12.5000	23.5000	21.2333	0.0000
25.0000	16.7000	16.7000	0.2135
50.0000	13.8000	13.8000	0.3501
100.0000	2.3000	2.3000	0.8917

P Value	Estimated Concentration	95% Confidence Limits Lower	Upper
25	31.6810	19.149	56.694

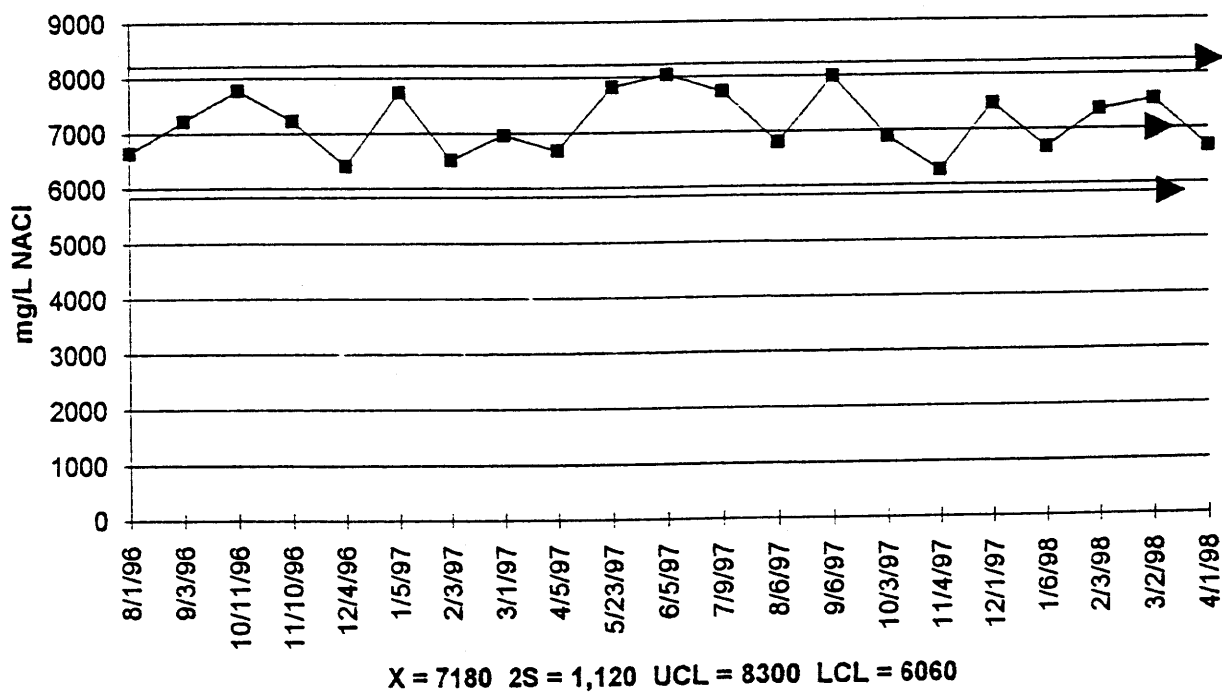
Note: # bootstrap resamplings = 120



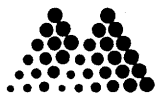


## Quality Control

Reference Toxicant Chronic LC50 Fathead Minnows April 1998



# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

Sample ID: In Mine  
Matrix: Water

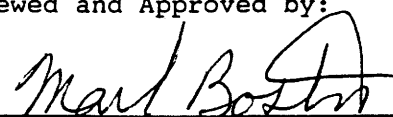
MSAI Sample: 99260  
MSAI Group: 27419  
Date Reported: 06/21/99  
  
Discard Date: 07/21/99  
Date Submitted: 06/18/99  
Date Sampled: 06/15/99  
Collected by:  
Purchase Order:  
Project No.: UC 572-03

Test	Analysis	Results		Dilution	Limit of	Method
		as Received	Units			Detection
				Factor	Quantitation	Limit
0206	Solids, Total Suspended (TSS)	U	mg/l	1	25.0	5.00
	Method: EPA 160.2					

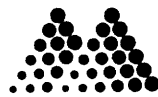
- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

  
Mark W. Bostrom  
Project Manager

# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

Sample ID: Pond 01  
Matrix: Water

MSAI Sample: 99259  
MSAI Group: 27419  
Date Reported: 06/21/99  
  
Discard Date: 07/21/99  
Date Submitted: 06/18/99  
Date Sampled: 06/15/99  
Collected by:  
Purchase Order:  
Project No.: UC 572-03

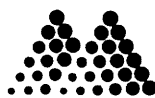
Test	Analysis	Results	Units	Dilution Factor	Limit of Quantitation	Method
		as Received				Detection Limit
0206	Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	25.0	5.00

- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

  
Mark W. Bostrom  
Project Manager



## Mountain States Analytical, Inc.

*The Quality Solution*

# Analytical Report

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

MSAI Sample: 99261  
MSAI Group: 27419  
Date Reported: 06/21/99

Discard Date: 07/21/99  
Date Submitted: 06/18/99  
Date Sampled: 06/17/99  
Collected by:  
Purchase Order:  
Project No.: UC 572-03

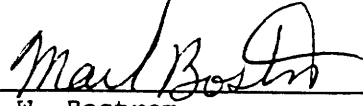
Sample ID: In Mine  
Matrix: Water

Test	Analysis	Results		Dilution	Limit of	Method
		as Received	Units		Quantitation	Detection
				Factor		Limit
0206	Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	25.0	5.00

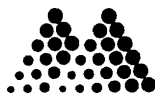
- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

  
Mark W. Bostrom  
Project Manager

# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining LLC

Sample ID: In-Mine  
Matrix: Water

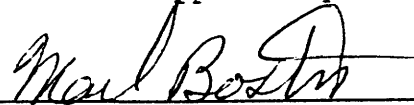
MSAI Sample: 99424  
MSAI Group: 27468  
Date Reported: 06/28/99  
  
Discard Date: 07/28/99  
Date Submitted: 06/23/99  
Date Sampled: 06/20/99  
Collected by:  
Purchase Order: UC 572-03  
Project No.: UC 572-03

Test	Analysis	Results		Dilution	Limit of	Method
		as Received	Units		Quantitation	Detection
				Factor		Limit
0206	Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	25.0	5.00

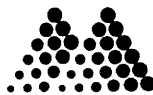
- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

  
Mark W. Bostrom  
Project Manager

# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

Sample ID: In Mine 6-22-99  
Matrix: Water

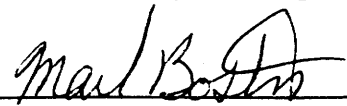
MSAI Sample: 99688  
MSAI Group: 27524  
Date Reported: 07/01/99  
  
Discard Date: 07/31/99  
Date Submitted: 06/28/99  
Date Sampled: 06/22/99  
Collected by: VM  
Purchase Order:  
Project No.: UC 572-03

Test	Analysis	Results		Dilution	Limit of	Method
		as Received	Units		Quantitation	Detection
				Factor		Limit
0206	Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	25.0	5.00

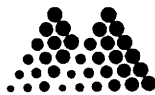
- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

  
Mark W. Bostrom  
Project Manager

# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

(Revised 07/06/99)

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

Sample ID: In Mine 6-25-99  
Matrix: Water

MSAI Sample: 99689  
MSAI Group: 27524  
Date Reported: 07/01/99  
  
Discard Date: 07/31/99  
Date Submitted: 06/28/99  
Date Sampled: 06/25/99  
Collected by: VM  
Purchase Order:  
Project No.: UC 572-03

Test Analysis	Results		Dilution	Limit of	Method
	as Received	Units			
			Factor	Quantitation	Detection Limit
0206 Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	25.0	5.00

- U - Not detected at the Method Detection Limit.  
J - Compound Detected below the Limit of Quantitation.

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and Approved by:

Mark W. Bostrom  
Project Manager



# Analytical Report



**Mountain States Analytical, Inc.**

*The Quality Solution*

Earthfax Engineering, Inc.  
7324 So. Union Park Ave.  
Suite 100  
Midvale, UT 84047

Attn: Mrs. Vicki Miller  
Project: Horizon Mining

Sample ID: In Mine  
Matrix: Water

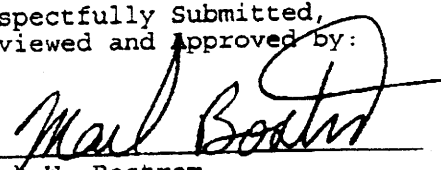
MSAI Sample: 99750  
MSAI Group: 27550  
Date Reported: 07/12/99  
  
Discard Date: 08/11/99  
Date Submitted: 06/30/99  
Date Sampled: 06/28/99  
Collected by: VM  
Purchase Order:  
Project No.:

Test Analysis	Results as Received	Units	Dilution Factor	Method Detection Limit	Date Analyzed Analyst
0206 Solids, Total Suspended (TSS) Method: EPA 160.2	U	mg/l	1	5.00	07/02/99 NS

- U - Not detected at the Method Detection Limit.  
D - Compound Detected below the Limit of Quantitation

This report consists of the following items: A cover letter, a signed analytical report for each sample specified on the cover letter, and if applicable, an inorganic quality control summary. Organic sample reports contain footnotes which describe any quality control anomalies which may have occurred.

Respectfully Submitted,  
Reviewed and approved by:

  
Mark W. Bostrom  
Project Manager

Approximate Gallons per Day

[illegible]

HORIZON IN-MINE WATER LOG 1999  
Approximate Gallons per Day

DAY	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY
1		X	X	X	X	X	Q
2		X	X	X	X	X	Q
3	X	X	X	X	X	X	Q
4	X	X	X	X	S	S	Q
5	X	X	X	X	X	S	Q
6	X		X	X	X	S	
7	X			X	S	S	
8	X		X	X	X	S	Q
9			X	X	X	S	Q
10	X		X		X	X	Q
11	X	X	X	X	X	X	Q
12	X	X	X	X	X	X	Q
13	X	X	X	X	X	X	Q
14	X	X	X	X	X	X	Q
15	X	X	X	X		X	Q
16		X	X	X		X	Q
17	X	X	X		X	X	Q
18	X	X	X	X	X	X	Q
19	X	X	X	X	X	X	Q
20	X		X	X	S	S	Q
21	X	X	X	X	S	S	Q
22	X	X	X	X	S	S	Q
23	X	X	X	X	X	X	
24	X	X	X	X	S	X	Q
25	X	X	X	X	X	X	Q
26	X	X	X	X	X	X	Q
27	X		X	X	X	X	Q
28	X		X	X	X	X	Q
29	X		X	X	X	X	
30			X	X	X	X	
31			X		X		S

Month	GALLONS FLOW PER DAY (gpd)	CHART SYMBOLS
April 1998	18,000	X = 18,000 gpd S = 9,000 gpd
May	28,000	X = 28,000 gpd S = 14,000 gpd
June	18,000 - 34,000	X = 32,000 gpd S = 18,000 gpd
July	21,600 - 75,000	X = 72,000 gpd S = 21,600 gpd
Aug	50,000 - 110,000	X = 110,000 gpd S = 50,000 gpd
Sept	23,500 - 75,000	X = 72,000 gpd S = 23,500 gpd
Oct	23,500 - 69,000	X = 67,000 gpd S = 23,500 gpd
Nov	21,500 - 70,000	X = 56,000 gpd
Dec	14,000 - 50,100	X = 50,000 gpd S = 14,000 gpd
Jan 1999	21,000 - 70,000	X = 62,000 gpd
Feb	60,000 - 90,000	X = 82,000 gpd
March	27,000 - 78,000	X = 70,000 gpd
April	54,000 - 135,000	X = 120,000 gpd
May	150,000 - 170,000	X = 150,000 gpd S = 74,000 gpd
June	150,000 - 180,000	X = 170,000 gpd S = 104,000 gpd
July	150,000 - 180,000	Q = 150,000 - 180,000 No employees on site to measure daily

All quantities are approximate, measurements were taken at a weir or pipe with a bucket .